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<p>(21) International Application Number: PCT/GB96/02886</p> <p>(22) International Filing Date: 22 November 1996 (22.11.96)</p> <p>(30) Priority Data: 9524005.7 23 November 1995 (23.11.95) GB</p> <p>(71) Applicant (for all designated States except US): FORBO INTERNATIONAL S.A. [CH/CH]; Eglisau, CH-8193 Zürich (CH).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): ROGERS, Edward, Harris [GB/GB]; 2 Ramsay Crescent, Burntisland, Fife KY3 9JL (GB).</p> <p>(74) Agents: McCALLUM, William, Potter et al.; Cruikshank &amp; Fairweather, 19 Royal Exchange Square, Glasgow G1 3AE (GB).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report.</p> <p>(27) <i>SDTA</i></p>
<p>(54) Title: LINOLEUM FLOOR-COVERING</p> <div data-bbox="292 1113 1331 1428"><p>Diagram illustrating a cross-section of a linoleum floor-covering. The structure consists of a carrier (6) with a first layer (4) of cured linoleum composition on one side and a second layer (11) of cured linoleum composition on the other side. The layers are bonded together. A label 14 points to the interface between the two layers.</p></div> <p>(57) Abstract</p> <p>The present invention provides a linoleum floor-covering comprising a carrier (6) and a layer (4) of cured linoleum composition adherently attached at one side of the said carrier (6), wherein a second layer (11) of cured linoleum composition is adherently attached at the other side of the carrier (6). In a further aspect the invention provides a method of manufacture of a linoleum floor-covering in which a first layer (4) of a linoleum composition is applied at a first side of a carrier (6) and a second layer (11) at a second side of said carrier (6). The first and the second layers (4, 11) are then cured so as to form a composite sheet in which said first and second layers (4, 11) and carrier (6) are bonded together.</p>		

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tiles, which have to be packaged and stored before final use. This particular problem was recognised and addressed by European Patent 0 074 681 B2 of Forbo-Krommenie BV, which specifies a carrier or substrate in the form of an open mesh woven fabric which endows the material with acceptable dimensional stability. The construction specified in patent 0 074 681 B2 1982 is however still essentially heterogenous or "unbalanced" so that differential stresses in the layers can still lead to unacceptable curling. Complex and rigid control measures are therefore needed in the manufacturing process in order to ensure the production of an acceptable product.

Linoleum tiles must therefore be produced on a different carrier (usually more expensive) to material produced in sheet form when the process outlined in European Patent 0 074 681 B2 is employed. Processing methods also differ for these two types of product. This leads to production complexity and costs, and additional inventory cost, when a manufacturer wishes to offer both tiles and sheet material to the market place. Moreover traditional linoleum must be stuck overall to the sub floor due to its inherent dimensional instability in order to prevent dimensional change leading to bulging, seam "gapping", curling etc. in use.

It is an object of the present invention to avoid or minimize one or more of the above disadvantages.

It has now been found that the dimensional stability and resistance to curl of linoleum floor coverings can be substantially improved by the application of a linoleum composition to both sides of the carrier or substrate in the course of manufacture of the floor covering.

Thus the present invention provides a method of manufacture of a linoleum floor covering comprising the steps of:  
providing a carrier;  
applying a first layer of a linoleum composition at a first

## LINOLEUM FLOOR-COVERING

The present invention relates to the manufacture of floor-coverings, and more particularly to the manufacture of linoleum floor-coverings.

- 5 Conventionally linoleum is manufactured from a substrate consisting of jute fabric, on which a hot plastic mass of oxidised linseed oil, and rosin, organic and inorganic fillers and pigments and, as the case may be, further additives, is calendered. The web thus obtained is
- 10 introduced into a drying chamber in which it is suspended in loops at a temperature of around 80°C, and the upper layer is allowed to cure or set therein by oxidative uptake of atmospheric oxygen to provide a suitably tough, flexible wearing surface. After leaving the drying chamber, the web
- 15 is cut to the required length, and is wound on rolls.

In common with many floor-covering materials based on this type of construction, where a wear resistant surface is applied to a "carrier" backing, difficulties of dimensional stability and curling of sheets when cut for installation

20 are encountered. This is due to differential stresses being introduced to the component layers during manufacture, or on exposure to differing ambient conditions in the use of floor-covering. As linoleum employs substances in its production such as woodflour and cork, which are sensitive

25 to differing moisture levels in the environment, problems of curl and dimensional stability can be particularly troublesome.

Whilst the above may not present a problem where traditional linoleum in sheet form is intended to be stuck overall to

30 the floor, using suitable adhesives, which restrain the material from further movement from its installed dimensions, where tiles are cut from traditional linoleum these can change significantly in dimension between production and installation. Traditional linoleum is

35 therefore unsuitable as the basis for cutting linoleum

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The first and second layers may be substantially similar, and desirably are of a generally comparable thickness and composition so as to provide a balanced resistance to curl or other dimensional distortion at both sides of the product. Nevertheless it may be desirable to have differences, for example, for reasons of economy the lower side layer may have a greater filler content whilst the composition of the upper side layer may be optimized for greater wear resistance by generally known means such as modifying the composition. Where there are differences between the layers then these are desirably implemented in a combination of parameters (e.g. thickness and composition so that the stresses are balanced in the final cured material. In most cases though it is possible to use more or less identical first and second layers e.g. for manufacturing convenience.

Where it is desired to use substantially different compositions in the first and second layers e.g. to provide distinct top (wear) and lower layers, then the "balancing" of these, most conveniently by means of adjustment of their relative thickness in the final floor-covering, may be carried out by simple trial and error - as with other laminated multi-layer sheet materials.

It will also be appreciated that the overall thickness of the product may be varied similarly to conventional floor-coverings with smaller thicknesses e.g. 2mm being used for lighter wear applications and greater thicknesses such as 2.5 and 3.2mm being used for more critical applications. Thus in general the floor-coverings of the invention can have overall thickness of from 1 to 6mm, preferably from 1.5 to 4mm.

Various kinds of carrier may be used in the floor-coverings of the invention including woven and non-woven fabrics, of natural and synthetic material. Thus the carrier may be of jute as in traditional linoleum floor-coverings or other natural fibre such as cotton and sisal. There may also be

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side of said carrier;  
applying a second layer of a linoleum composition at a  
second side of said carrier; and  
curing said first and second layers of linoleum composition  
5 so as to form a composite sheet in which said first and  
second layers and carrier are bonded together.

In another aspect the present invention provides a linoleum  
floor-covering comprising a carrier and a layer of cured  
linoleum composition adherently attached at one side of the  
10 said carrier, characterized in that a second layer of cured  
linoleum composition is adherently attached at the other  
side of said carrier.

Thus by means of the present invention there is provided a  
linoleum floor-covering with substantially greater  
15 dimensional stability than previously known linoleum floor-  
coverings thereby allowing them to be laid with only limited  
securing e.g. at seams and doorways, without the need for  
gluing of the whole area. The material may moreover be cut  
into dimensionally stable tiles thereby facilitating DIY  
20 installation by non-specialist personnel and other  
applications.

The linoleum compositions used in the first and second  
layers of the floor coverings of the present invention may  
be substantially similar to those used in conventional  
25 linoleum floor coverings. Thus in general each of the first  
and second layers comprises a "cement" (polymeric component)  
and a filler which may be organic and/or inorganic, and if  
desired a pigment. The cement generally comprises a so-  
called drying oil, usually a polyunsaturated oil such as  
30 linseed oil, fish oil, soya oil etc. which can be oxidised  
by atmospheric oxygen to form a dry solid, with linseed oil  
being particularly preferred because of its faster drying  
characteristics. Additional ingredients such as rosin may  
be included in the cement in order to improve the strength  
35 of the cement and the wear characteristics of the final  
floor covering layer compositions.

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used synthetic fibres such as polyester, polyamide, polyacrylate, glassfibre etc. Preferably the carrier is of a more or less open structure and/or substantially porous material so as to facilitate penetration of the linoleum compositions through the carrier layer to assist in bonding thereof to the carrier and/or to each other, and to encapsulate more fully the carrier. In order to enhance bonding of the linoleum layers to the carrier, the latter may be provided with an adhesive coating which may be based on a natural drying oil such as linseed oil or soya oil or similar, or it may be based on a synthetic material such as acrylic, styrene butadiene rubber or similar.

The linoleum compositions may be applied to the carrier using known procedures. Thus a hot thermoplastic linoleum composition, which generally comprises a mixture of oxidised linseed oil and resin, organic and/or inorganic fillers such as woodflour and chalk powder, and pigments as required, and may conveniently be formed into granules or the like, is generally formed into a sheet by extrusion using slot extruder or by pressing using a calendar, belt or band press, laminating press or a static press means. Sheets formed of linoleum composition so formed may then be applied to opposite sides of the carrier, usually separately, but if desired, simultaneously. As noted before the sheets at opposite side of the carrier may be of similar or different form and composition.

The composite multi-layer structure of carrier and "green" (or uncured) linoleum composition is then cured. This may be carried out in generally conventional manner by hanging in loops in a heated chamber, e.g. at about 80°C, until curing has been completed. This may typically take from 2 to 4 weeks, i.e. a similar time or possibly shorter, than with conventional linoleum floor-coverings. Completion of curing may be readily determined in known manner by monitoring the physical characteristics such as for example indent resistance of samples of the floor-covering at convenient intervals.

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The outer surfaces of the upper and/or lower linoleum layers may be plain or may be decorated by known linoleum production techniques to give a marble, or granite, or jaspé, or moiré appearance, or they may be decorated by any other suitable technique. Thus for example granules of two or more, more or less identical, compositions but with different colours may be blended prior to formation of the granules into a sheet form. Also two or more intermediate form sheets may be processed e.g. calendered together so as to form a final, first or second, layer sheet. Either or both surfaces of the floor-covering material may moreover be smooth or textured e.g. embossed in generally known manner.

Further preferred features and advantages of the invention will appear from the following detailed examples given by way of illustration together with the accompanying drawings in which:

Fig. 1 is a schematic representation of one embodiment of a production process of the invention; and

Fig. 2 is a cross-section of one embodiment of a linoleum floor-covering of the invention.

#### Example 1. Production of Linoleum Floor-Covering

##### A. First Layer Linoleum Composition

A linoleum composition was prepared in conventional manner by mixing ingredients listed below in a 'Banbury' type internal batch mixer for 6 minutes at a temperature of 80°C to produce a thick pasty mass having the following composition:

	<u>% w/w</u>
Oxidised Linseed Oil	40
Woodflour	40
Chalk Powder	15
Pigments	5

The mass was then formed into granules by passing through a dicing machine.



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### B. Second Layer Linoleum Composition

This was identical to the first layer.

### C. Application of Linoleum Compositions to Carrier

As shown in Fig. 1, the first layer composition 1 is fed from a first hopper 2 at a temperature of about 50°C into the nip of a first calendar 3 to form a first layer sheet 4 having a thickness of about 1.25mm. The latter is then passed through the nip of a first laminating press 5 together with a carrier web 6. The latter comprises a woven polyester mesh having typically a specification as follows:

Weight	25g/m <sup>2</sup>
Sett	2/29x20 thd/dm
Warp	150 dtex MF Polyester
Weft	500 dtex MF Polyester

15 "thd/dm" means thread per decimetre.

"dtex" is a measurement of thread weight. The specification refers to the weight per thousand metres of thread.

"MF" means multi filament

The composite first layer/carrier 7 is then inverted by passing through a suitable arrangement of carrier rollers 8. The second layer composition 9 is fed to a second calendar 10, to form a second layer sheet 11, having a thickness of about 1.25 mm, which is then applied to the opposite surface 12 of the carrier 6 to the first layer 4, before being passed through a second laminating press in the form of a belt press 13, together with the previously formed first layer/carrier laminate, to form a composite sheet 14 having an overall thickness of about 2.5 mm.

The green composite sheet 14 is then hung out over support bars 16 in a conventional curing chamber 17 wherein it is maintained at a temperature of about 80°C until it is cured - typically after a few weeks.

It will be appreciated that various changes may be made to

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the abovedescribed example without departing from the scope of the present invention. Thus for example instead of a batch-type mixer there could be used a continuous mixer, various forms of which are well-known in the art.

5 Example 2.      Properties of Linoleum Floor-Covering

The floor-covering produced in Example 1 was found to be highly flexible, being bendable without breaking around a radius of 25mm at either side (i.e. base or wear side) (tested in accordance with prEN 669). Sheets which had been  
10 cut into tiles (500mm x 500mm) were found to maintain their length and breadth dimensions to within 0.1% when tested according to EN435 method A.

Example 3.      Production of Linoleum Floor-Covering

A. Top (Wear) Layer Linoleum Composition

15 This was substantially similar to that used in example 1A except that the "oxidised linseed oil" component (commonly referred to in the industry as "cement" or "linoleum cement") included a small amount of tall oil for reasons of economy and some rosin to improve the wearing properties of  
20 the final layer composition, as follows:

<u>Top Layer Cement</u>	<u>% w/w</u>
Linseed Oil	75
Tall Oil	15
Rosin	10

25 The cement was prepared in generally well known manner by mixing together the above components at a temperature of the order of 80 to 110°C for some 20 to 30 hours in a temperature controlled vessel while the mixture was continuously aerated.

30 The cement was then mixed with the other top layer components and formed into granules in the same way and proportions as in Example 1A.

B. Lower Layer Linoleum Composition

In this case there was used a cement with the following composition:

<u>Lower Layer Cement</u>	<u>% w/w</u>
5 Linseed Oil	60
Tall Oil	40

which is significantly more economical than the top layer cement. The cement was prepared using the same procedures as in Example 3A.

- 10 The lower layer cement was then mixed with other lower layer components in the following proportions:

<u>Lower Layer Composition</u>	<u>% w/w</u>
Lower Layer Cement	35
Wood flour	12
15 Chalk Powder	24
Recycled Linoleum	25
Pigment	4

- 20 Thus in this case a somewhat lower amount of cement was used and a significant amount of recycled scrap linoleum floor covering e.g. edge trimmings, was incorporated, for reasons of economy.

The lower layer composition components were mixed together and formed into granules substantially as described in Example 1A.

25 C. Application of Linoleum Compositions to Carrier

- The granulated lower layer composition was applied to a carrier as described in Example 1C followed by the granulated top (wear) layer composition to produce a green linoleum floor covering with a 1.25 mm thick top (wear) layer and a 1.25 mm thick lower layer, which was then cured as before.
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CLAIMS

1. A linoleum floor-covering (14) comprising a carrier and a layer (4) of cured linoleum composition adherently attached at one side of the said carrier (6), characterized in that a  
5 second layer (11) of cured linoleum composition is adherently attached at the other side of said carrier (6).
2. A floor-covering according to claim 1 wherein said first and second layers (4,11) have a substantially similar thickness and composition.
- 10 3. A floor-covering according to claim 1 or claim 2 wherein an upper, wear, side (4) one of said first and second layers (4,11) has a composition with a greater wear resistance than the lower side (11).
- 15 4. A floor-covering according to any one of claims 1 to 3 wherein a lower side (11) one of said first and second layers (4,11) has a greater filler content than the upper, wear, side one (4).
- 20 5. A floor-covering according to any one of claims 1 to 4 wherein said first and second layers (4,11) are formed and arranged so as to provide a balanced resistance to at least one of curl and other dimensional distortion.
- 25 6. A floor-covering according to any one of claims 1 to 5 wherein said carrier (6) has a substantially open structure so as to facilitate penetration of the linoleum compositions into and around the carrier.
7. A floor covering according to any one of claims 1 to 6 wherein said carrier (6) is substantially porous so as to facilitate penetration of the linoleum compositions into and around the carrier.
- 30 8. A floor-covering according to any one of claims 1 to 7 wherein said carrier (6) has an adhesive coating for

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promoting adhesion of the linoleum compositions thereto.

9. A method of manufacture of a linoleum floor covering comprising the steps of:
- providing a carrier (6);
  - 5 applying a first layer (4) of a linoleum composition at a first side of said carrier (6);
  - applying a second layer (11) of a linoleum composition at a second side of said carrier (6); and
  - curing said first and second layers (4,11) of linoleum
  - 10 composition so as to form a composite sheet (14) in which said first and second layers (4,11) are bonded together.

10. A method according to claim 9 which includes the preliminary step of forming at least one of said first and second layers (4,11) into a sheet prior to application
- 15 thereof to a respective side of said carrier (6).

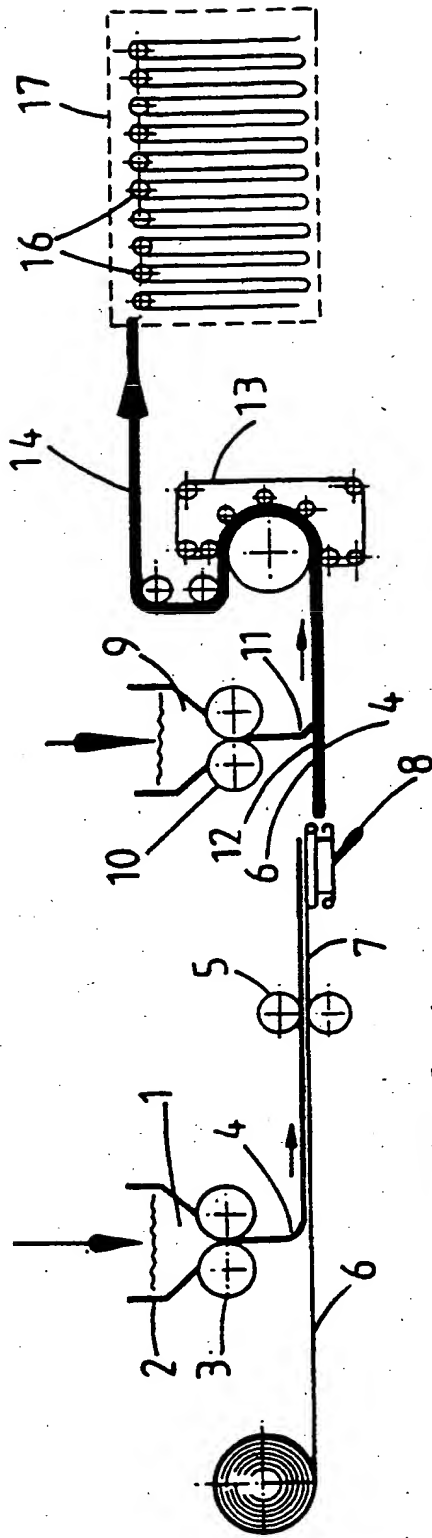


FIG. 1

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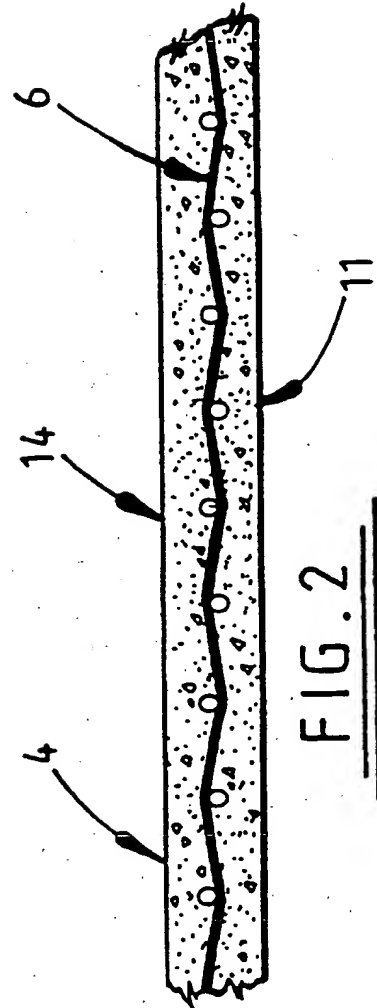


FIG. 2

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 96/02886

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 D06N1/00 B32B5/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 D06N B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 395 706 C (ELEKTRIZITÄTSWERK LONZA AKT.-GES.) 19 November 1921	1,2,5,9
Y	see the whole document	10
Y	US 2 894 560 A (M.C. NELSON ET AL.) 14 July 1959 see column 4, line 67 - column 5, line 43; figures	10
A	US 1 348 571 A (JOHANNES HENDRIKUS PHILIPPUS LIGTERINK) 3 August 1920 see abstract	1,2,5-7,9
A	EP 0 074 681 A (FORBRO KROMMENIE BV) 23 March 1983 cited in the application see page 1, paragraph 1	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 96/02886

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-C-395706		NONE	
US-A-2894560	14-07-59	NONE	
US-A-1348571	03-08-20	NONE	
EP-A-0074681	23-03-83	NL-A- 8104177	05-04-83